Electronic Supplementary Information

Vinylene Spacer Effects of Benzothiadiazole-Quarterthiophene Based Conjugated Polymers on Transistor Mobilities

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1. General information

Chemicals were purchased form Alfa-Aesar, Sigma-Aldrich etc. and used without further purification. Gel permeation chromatography (GPC) analysis was performed on a Waters 1515 chromatograph at 35 ℃, polystyrene was used as the calibration standard and THF as eluent. Elemental analysis was performed on a Carlo Erba model 1160 elemental analyzer. TGA-DTA measurements were carried out on a NETZSCH STA 449 F3 Jupiter® instruments under a dry nitrogen flow, heating from room temperature to 550 ℃, with a heating rate of 20 ℃/min. Cyclic voltammetric measurements were carried out in a conventional three-electrode cell using glassy carbon (GC) as working electrodes of 2 mm diameter, a platinum wire as counter electrode, and an Ag/AgCl reference electrode on a computer-controlled CHI660E instruments at room

temperature. FT-IR was measured with Spectrum Two FT-IR spectrometer from PerkinElmer. The GIXRD data were obtained at beam line 1W1A of the Beijing Synchrotron Radiation Facility for 1D diffraction profiles Cu Kα radiation (λ = 1.54178 Å). The molecular structures of the compounds were optimized using the DFT method at the level of RB3LYP/6-311G. All calculations were performed with the programs Gaussian 09.

2. TGA analysis

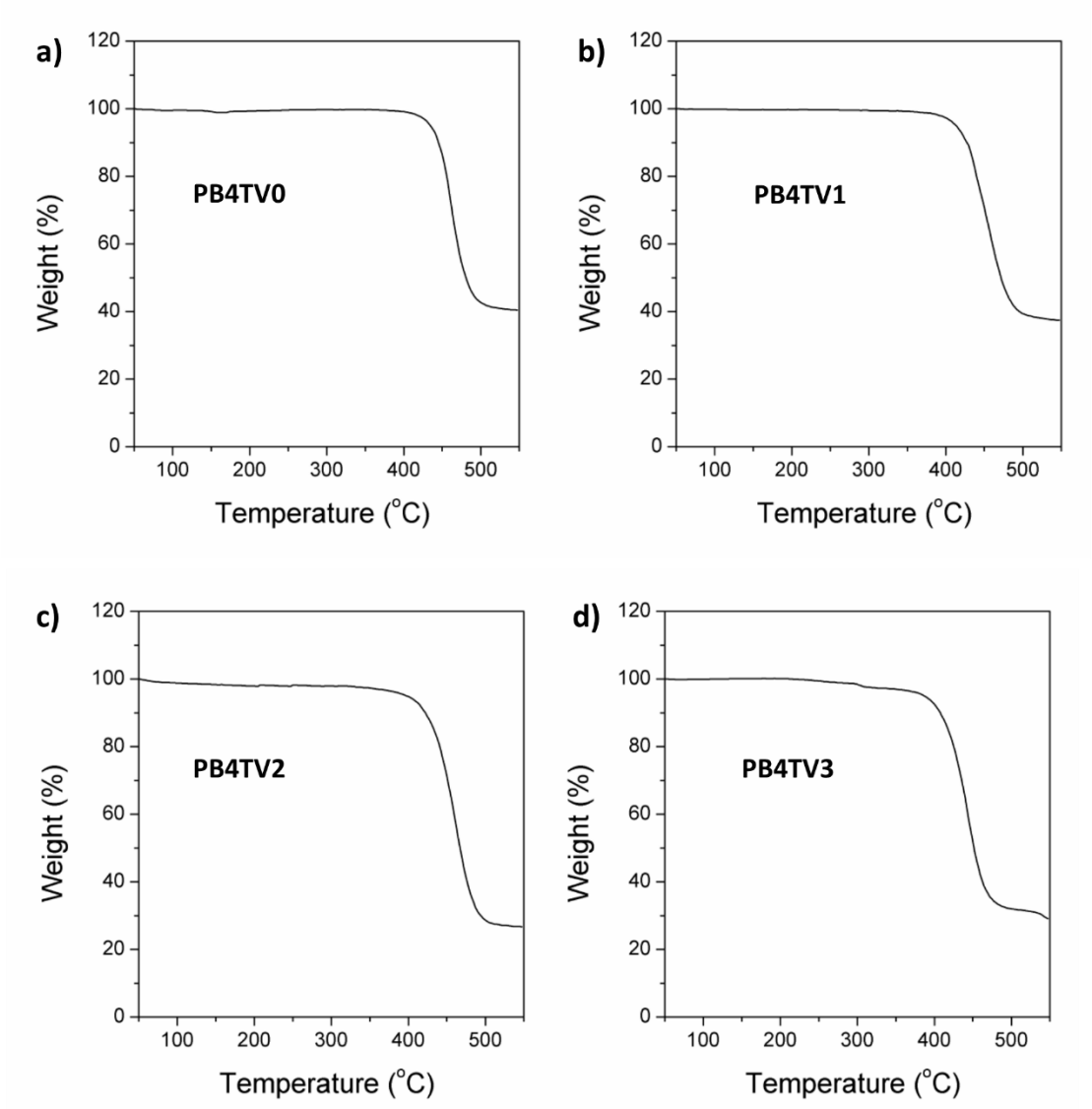

Figure S1. TGA analysis of **PB4TV0** (a)**, PB4TV1** (b)**, PB4TV2** (c) and **PB4TV3** (d).

3. Theoretical calculations

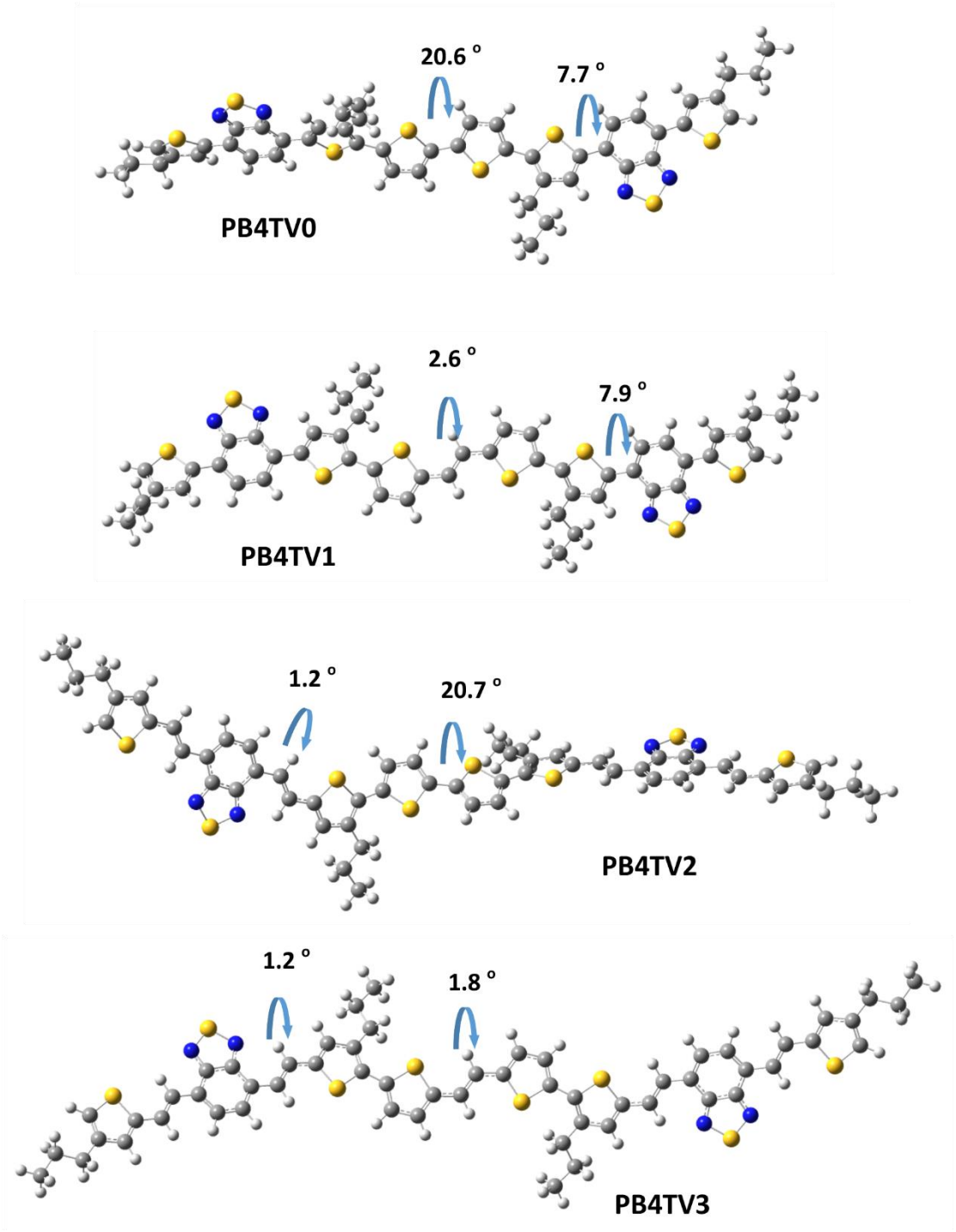

Figure S2. Calculated oligomer (n = 2) structures of PB4TV0, PB4TV1, PB4TV2 and PB4TV3. The results demonstrate clear smaller dihedral angels between the vinyl linked planes than the non-vinyl linked ones.

4. DSC analysis (ΔH/Δt vs. T)

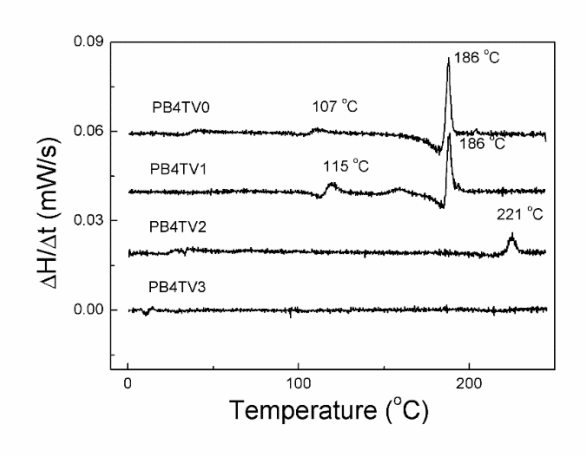

Figure S3. DSC analysis of polymer PB4TV0 to PB4TV3 plotted by ΔH/Δt vs. T.

5. FT-IR

Out-of-plane vinyl C−H bending is known to give strong IR absorptions for both *cis* (600−700 cm^{-1}) and *trans* (900−1000 cm^{-1}) stereoisomers (Structure Determination of Organic Compounds: Tables of Spectral Data, Springer: Heidelberg, Germany, 2000, p248−251). As depicted in figure S4, the emerging peaks at 926 cm^{-1} and 948 cm^{-1} clearly indicated that the vinyl linkers have been successfully introduced in PB4TV1 to PB4TV3. Furthermore, the increasing intensity of peaks at the *cis*- region from PB4TV1 to PB4TV3 suggests that the contents of the *cis*- isomer also increased along the raised vinyl ratio.

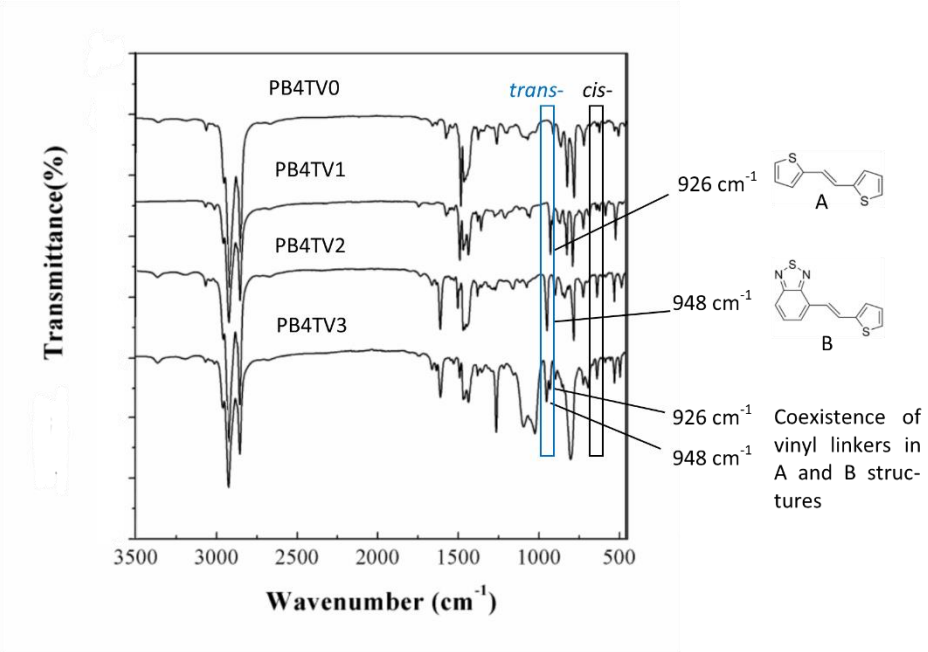

Figure S4. FT-IR spectra of polymer PB4TV0 to PB4TV3, and their typical out-of-plane bending peaks from vinyl linkers.

6. ^{1}H NMR

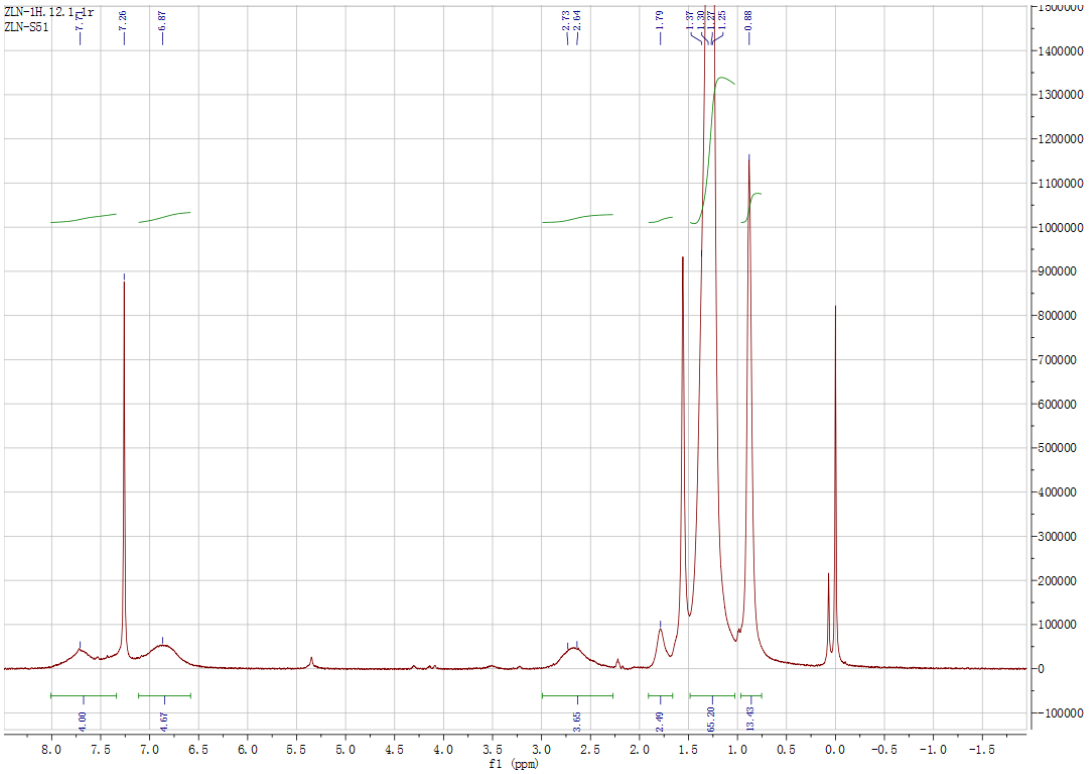

Figure S5. ^{1}H NMR of PB4TV0 (600 MHz, $CDCl_3$)

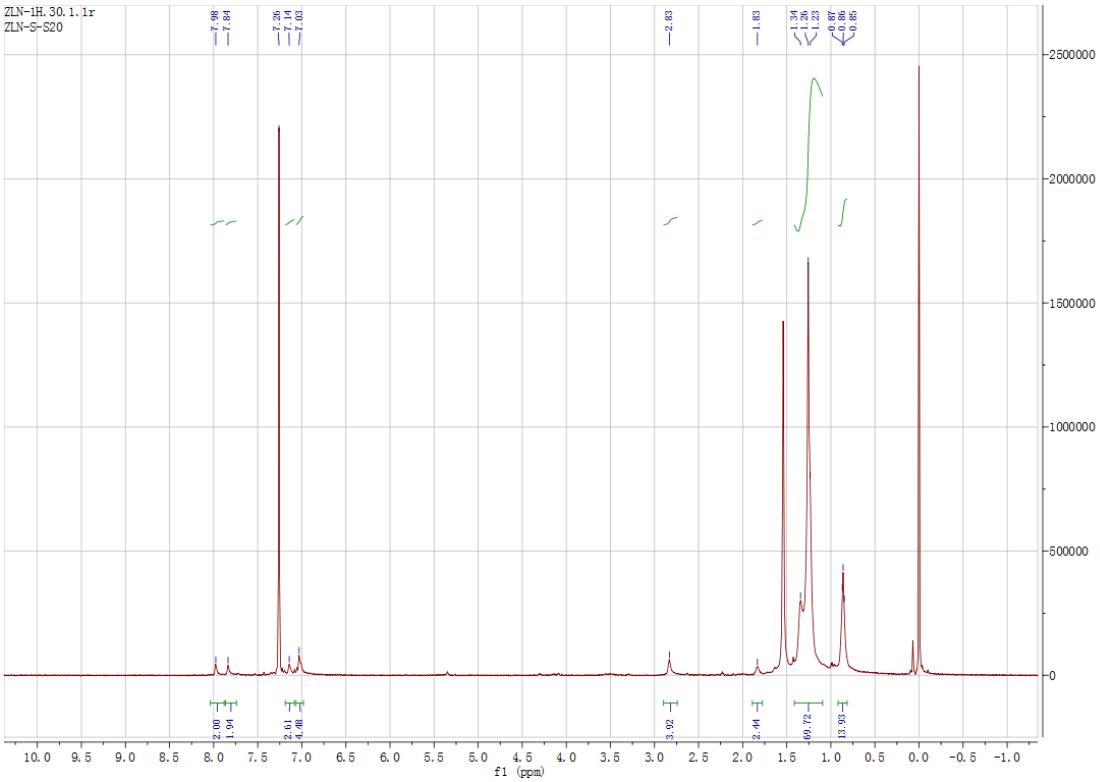

Figure S6. ^{1}H NMR of PB4TV1 (600 MHz, $CDCl_3$)

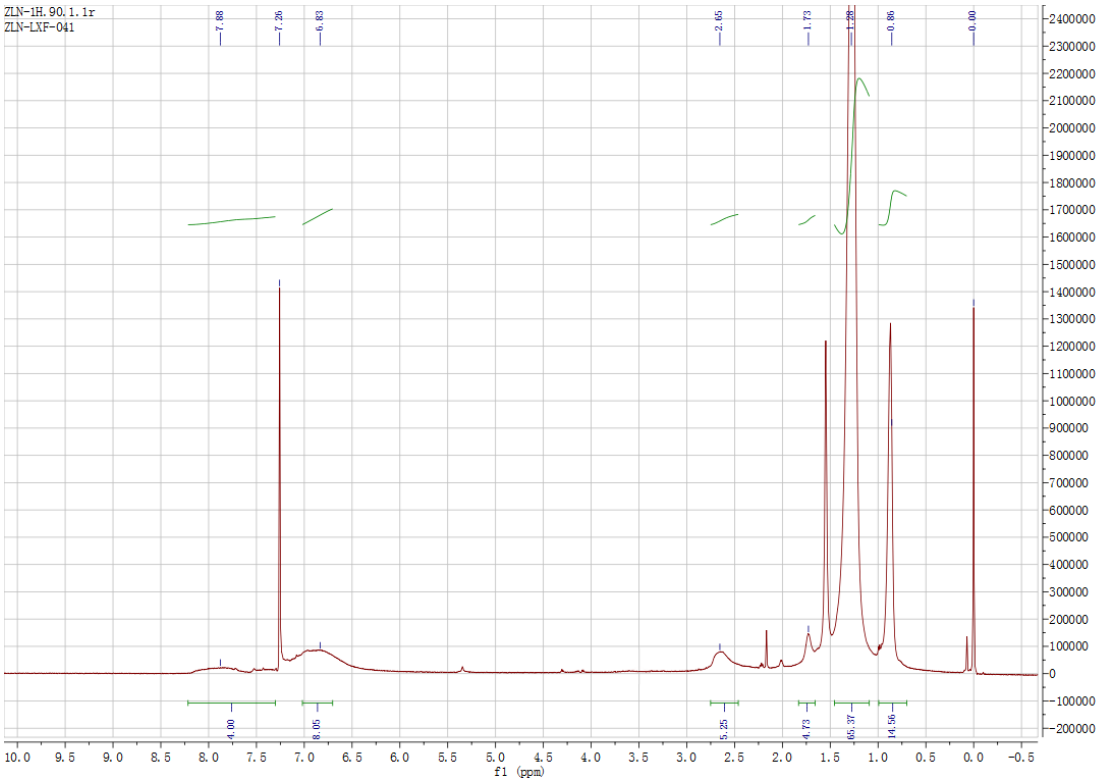

Figure S7. ^{1}H NMR of PB4TV2 (600 MHz, $CDCl_3$)

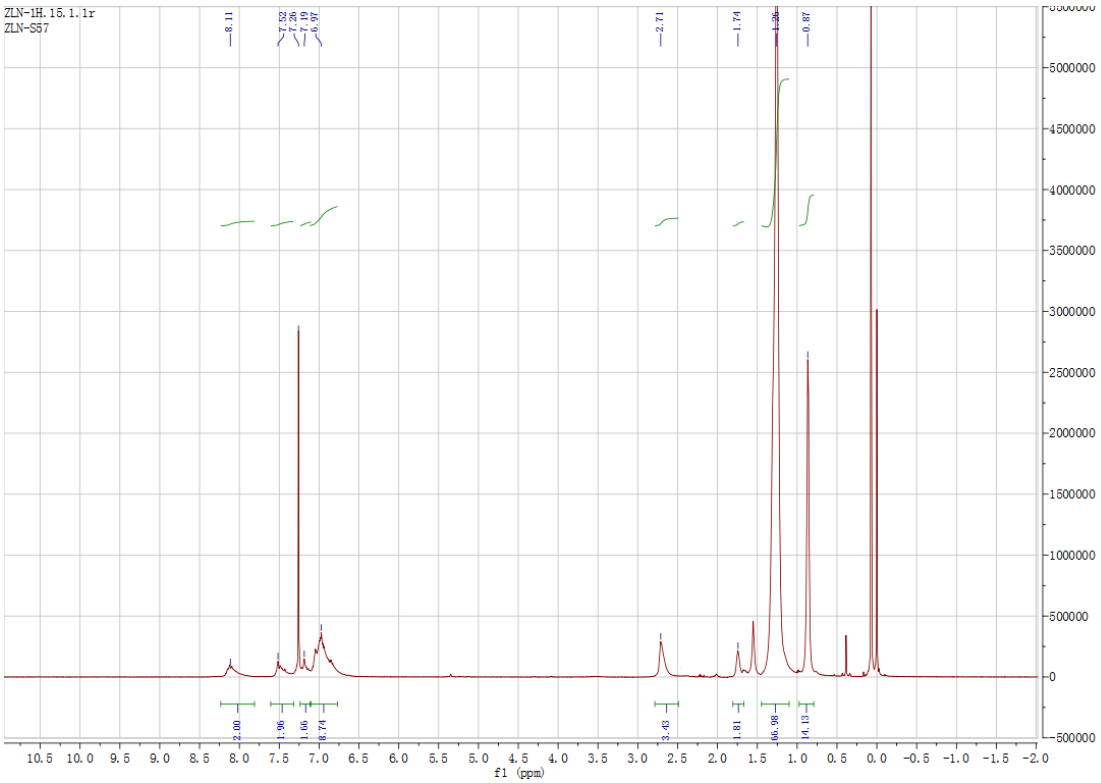

Figure S8. ^{1}H NMR of PB4TV3 (600 MHz, $CDCl_3$)